Are locomotive styles in primates a driving force behind intra- and interspecies variation in the vertebral column?

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Introduction

The vertebral column is made up of five regions (fig 1). In primates and humans, the total number of vertebrae is conserved. However within each region of the vertebral column, the number of vertebrae may vary within and between species. There are also some species who possess more so-called 'transitional' vertebrae, with features of more than one region (fig 2) and located between regions. Despite extensive study, we still do not know why this is or how patterns link to locomotion (fig 3), evolution and development.

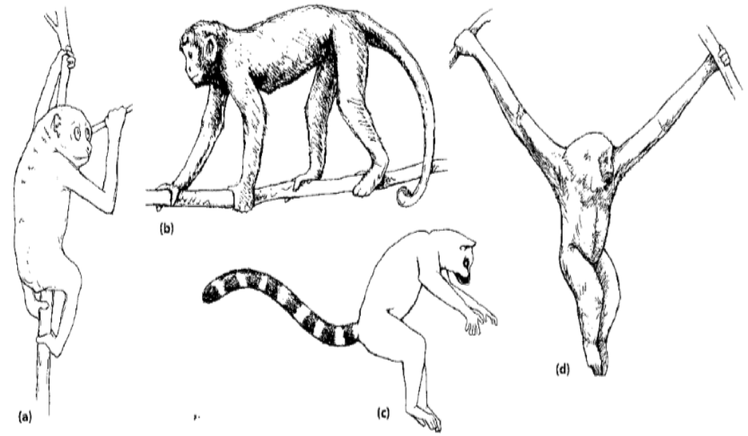

Figure 3: Different types of arboreal locomotion.: a) vertical clinging, b) arboreal quadrupedalism, c) leaping and d) brachiation (Gebo, 2014)

Current knowledge

In the primate's cervical regions, vertebral counts are always the same: seven. However in the other four regions, the thoracic, the lumbar, the sacral and the coccygeal/caudal, there is often more **variation**.

As the other regions are involved in movement and stabilizing the spine, it is possible that **locomotion** is a key aspect of this, especially as primate species use a variety of locomotive styles (fig 3), many species using **arboreal** locomotive styles, while some also or alternatively use **terrestrial** locomotive styles.

But could locomotion also explain why variation occurs **within a species** too?

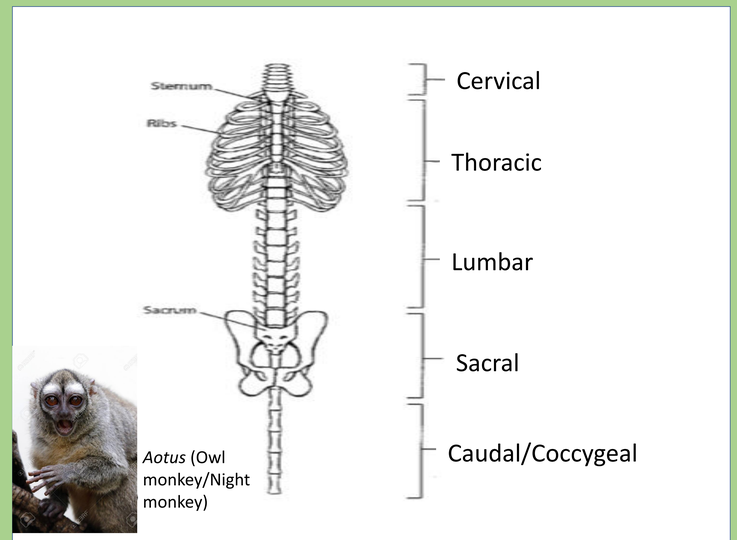

Figure 1 The vertebral column and its five regions (Gebo, 2014, edited by Payne, 2019)

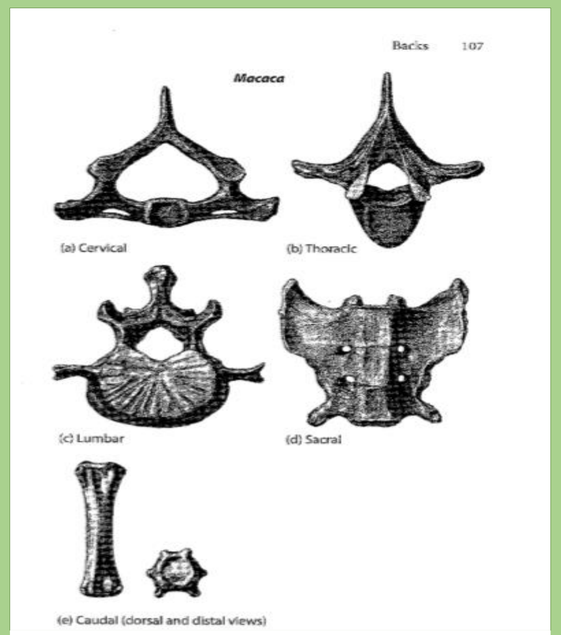

Figure 2: The shape of the different vertebrae: (Gebo, 2014)

Aims and Project outline

For my project, I have collected literature for systematic review and I will be examining different collections of primate vertebral column specimens. I will take count of the number of vertebrae and map out morphometric variation. I aim to see if locomotion is a driving force behind variation and if linked to variation in intraspecies as well as interspecies.

Significance of study

There has been recent studies into why variation occurs, such as when Galis *et.al* (2014), showed that fast mammals have **less stability** in their vertebral columns than slower mammals and Plomp *et.al.* (2015) demonstrated that lumbar vertebrae in humans are shaped **similar to those in chimpanzees.** However, there is still little research into why variation occurs **within a species.**

Other potential drivers for variation:

- Stress and hormonal affect on embryo growth (somites)
- Fusion and transitional intermediate vertebrae
- Changes in the function of one or two regions within the spine

It is also worth mentioning that as humans and great apes have lost their tail, this could be a factor in the variation of this particular region, though it doesn't explain variation in other primates.

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